D Vision Works Limited

D Sculptor ® 2.0

and

D Sculptor ® 2.0 Professional

user manual

Information in this document is subject to change without notice. No part of this document may be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without the express written permission of D Vision Works Limited. If, however, your only means of access to this document is electronic, permission to print one copy is granted.

D Vision Works Limited may have patents, patent applications, copyrights or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from D Vision Works Limited, the furnishing of this document does not give you any license to these patents, trademarks, copyrights or other intellectual property.

© 2000-2002 D Vision Works Limited. All rights reserved.

"D Sculptor" is a registered trademark of D Vision Works Limited.

Microsoft, Windows and Internet Explorer are either registered trademarks or trademarks of Microsoft Corporation. Macromedia, Director and Shockwave are registered trademarks of Macromedia, Inc. Java is a trademark of Sun Microsystems, Inc.

Other product and company names mentioned herein may be the trademarks of their respective owners.

TABLE OF CONTENTS

1 INTRODUCTION 1

1.1 Modelling with D Sculptor 1
1.2 New in version 2.0 1
1.3 About this Manual 2

2 TUTORIAL 3

2.1 Inserting Photos into the Project 3
2.2 Finding the Markers 3
2.3 Mask the object 4
2.4 Generate a mesh 8
2.5 Initialise Mask 10
2.6 Adjust polygon count 11
2.7 Generate a texture map 12
2.8 Export model 13
2.9 Camera positions 14
2.10 Other ways of changing the 3D viewpoint 16

3 MODELLING IN D SCULPTOR 23

3.1 Planning your project 23
3.2 Taking good pictures 23
3.3 The Marker Pattern 24
3.3.1 Square Marker Pattern 25

4 REFERENCE 27

4.1 Photos 27
4.2 Calibration Markers 27
4.2.1 Automatic Marker Detection 27
4.2.2 Manual Marker Editing 27
4.2.3 Printing a Marker Pattern 28
4.3 Masking 28
4.4 Generating a Model 30
4.5 Examining the Model 30
4.5.1 Rendering Modes 30
4.5.2 Camera positions 31
4.5.3 Backgrounds 31
4.6 Manipulating the texture map 31

4.6.1 Resizing the texture map 31
4.6.2 Enhancing the contrast of the texture map 32
4.6.3 Importing Wavefront files 32
4.7 Auto Generating Photos 32
4.8 Exporting D Sculptor models 33
4.8.1 3D Studio Export 33
4.8.2 Direct 3D Export 33
4.8.3 DXF Export 33
4.8.4 Java Export 33
4.8.5 Shockwave 3D Export 35
4.8.6 VRML Export 37
4.8.7 Wavefront Export 37
4.8.8 Bitmap Export 37
4.8.9 Copying 3D Mode Views to the Clipboard 37
4.9 The Options Menu 37
4.9.1 The Mesh Options Tab 38
4.9.2 The Photograph Options Tab 38
4.9.3 The 3D Options Tab 39
4.10 Keyboard Shortcuts 41

1 INTRODUCTION

D Sculptor allows you to create 3-D photo-realistic computer models of a wide range of objects using only ordinary photographs, quickly and easily. No special hardware is needed, just a computer and a camera. A digital camera is most convenient but scanned photos from film may also be used.

1.1 MODELLING WITH D SCULPTOR

The basic model making process is very simple:

- Position the object you want to model on a marker pattern.
- Take photos of the object from a number of different angles.
- Import these photographs into D Sculptor.
- Let D Sculptor automatically detect the marker pattern for you.
- Mark out the outline of the object in each photo using D Sculptor's built in masking tools.
- Let D Sculptor calculate the 3-D model for you.
- Export the 3-D model for use with other software packages as required.

1.2 NEW IN VERSION 2.0

D Sculptor 2.0 contains many improvements to both the technical performance and the user interface. You can make models much quicker than before and D Sculptor 2.0 Professional has advanced features for even greater accuracy.

- The masking tools have been updated to function more like those in popular bitmap editing programs and a "magic" wand tool has been added to facilitate very fast object masking if the object to be modelled has been photographed in front of a uniformly coloured background.
- Automatic marker detection has been added. It is now no longer necessary to manually point out the calibration markers on the calibration pattern, D Sculptor can automatically detect them and mark them out for you.
- To further speed modelling the "Initialise Mask" function has been added so that D Sculptor can make an initial guess for a mask once it has generated a first approximate model.
- The user interface is now more flexible and customisable.
- Switching between photos can now be done in the project explorer giving you convenient direct access to all the photos in a project.
- The project explorer also gives you convenient access to masks and 3D viewpoints.

D Sculptor 2.0 Professional includes the following to give even greater model accuracy:

- Use of multiple masks allows sub-parts of the object to be modelled separately and so gives significantly improved accuracy.
- The capability to merge two or more D Sculptor models allows modelling from all possible perspectives (including from below) and it improves accuracy.

1.3 ABOUT THIS MANUAL

Keystrokes and keyboard shortcuts are indicated in bold font and between square brackets. A "+" sign will be used if you have to press several keys at the same time. For example the keyboard shortcut to save the current D Sculptor project file would be indicated like this: **[Ctrl]+[S]**, which means you press the **[S]** key whilst holding down the **[Ctrl]** key.

Menu items will be indicated in bold so the File menu would be indicated as follows: **File**. Nested menu selections will be linked with a ">" so selecting the Copy entry on the Edit menu would be shown as **Edit > Copy**.

Along with this manual you will have received a separate appendix that lists system requirements and gives instructions for installing D Sculptor on your system.

Section 2 contains a detailed tutorial that walks you through the use of most of the features of D Sculptor. We strongly recommend that you work through the whole of this tutorial in order to get a good feel for how D Sculptor works.

In Sections 3 and 4 you will find more detailed information on some of the aspects of D Sculptor as well as suggestions for taking photos and modelling with D Sculptor in general.

Additional updates to this manual as well as other information on D Sculptor can be found on the D Vision Works website at:

www.d-vw.com

2 TUTORIAL

In this section you will learn how to construct a D Sculptor model and then export it for use in other software or publication to the Internet. Also you will learn about some of the more advanced functions in D Sculptor.

2.1 INSERTING PHOTOS INTO THE PROJECT

The first step in starting a new D Sculptor project is to insert some photos into the project. In this tutorial you will model an Egyptian artefact. To insert the photos into an empty D Sculptor project, locate the Tutorial folder which is usually in a subdirectory of the D Sculptor installation directory: …Program Files\D Vision Works\D Sculptor. Select **File > Insert Photos…** In the Insert Photos selection dialog box navigate to the …\Tutorial\Egyptian folder and select the files Egyptian 01.jpg through to Egyptian 16.jpg. You can select multiple files in the usual windows fashion either by pressing **[Control]** and clicking on each file name individually or by pressing **[Shift]** and clicking on the first and then on the last file name.

Once you have done this and the photos have been inserted into the D Sculptor project go to the first photo (Egyptian 01.jpg) by left clicking on its name in the D Sculptor project explorer and the D Sculptor workspace should appear as in Figure 1.

Before moving on to the next step, finding the markers, please make sure that both the Toggle Masks and Toggle Markers buttons are depressed to be sure you can see what you are doing.

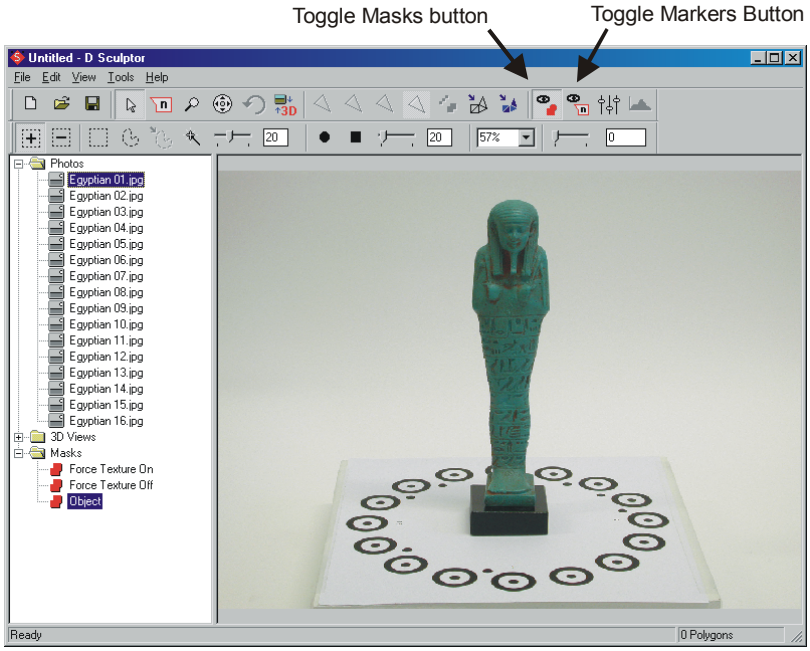

Figure 1: First photos loaded into project.

2.2 FINDING THE MARKERS

The first task to perform after loading the photos is to have D Sculptor find the markers on the marker pattern (the circular pattern the object

to be modelled is resting on). D Sculptor needs to find these markers so it can calculate the position of the camera for each photo. To do this:

- Select **Tools > Find Markers in Photo** *or*
- press **[Control]+F**

After a moment the markers should be automatically identified and they should be shown on screen as in Figure 2. If not then please check that the Toggle Markers button (Figure 1) is depressed.

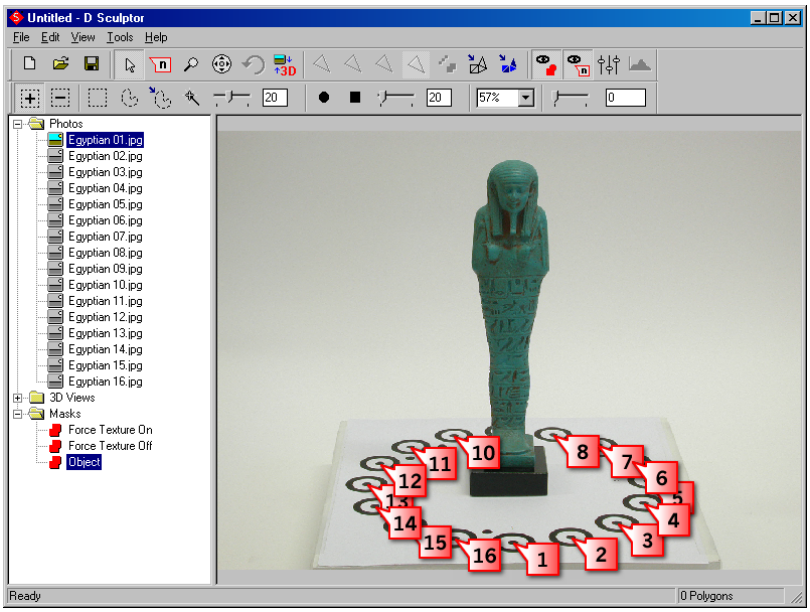

Figure 2: Markers found for first photo.

Also notice that the photo icon next to the Egyptian 01.jpg file name in the project explorer has turned coloured instead of black and white. This indicates that D Sculptor has successfully been able to determine the camera position from which this photo was taken.

To save time you can also ask D Sculptor to automatically find the markers for all photos in a project. To do this select **Tools > Find Markers in all Photos**. In a minute or two D Sculptor will now find the markers in all photos in the project and show you these markers as it goes along. Also the photo icons next to the file names will all turn coloured one by one as D Sculptor works out the camera positions for each photo.

For more information on markers and calibration see Section 4.2.

This is a good point to quickly save a copy of the current D Sculptor project. Select **File > Save As…** and save the project with a name of MyStep1.dsd into the same directory where the photos are stored.

2.3 MASK THE OBJECT

After the markers have been found you need to mask the object in all the photos. D Sculptor provides you with a number of tools for doing this quickly and efficiently. These tools are shown on the toolbar in Figure 3.

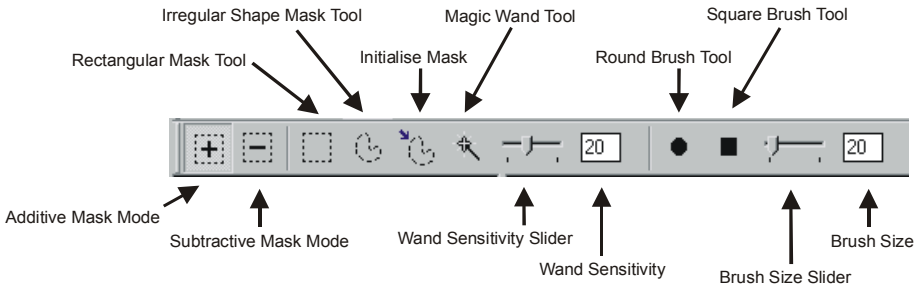

Figure 3: Masking tools.

When masking the calibration markers can sometimes get in the way. To temporarily hide them just click on the Toggle Markers button (Figure 1).

If the object mask isn't highlighted in the project explorer on the left then select it by clicking on Object in the Masks folder of the project explorer.

Start by drawing a rectangular mask round the object in the first photo. If necessary click on Egyptian 01.jpg in the project explorer to go to this photo. Make sure the additive masking mode is active by clicking on the Additive Mode Button (which should then appear selected) and then click on the Rectangular Mask Tool button to activate the rectangular mask tool.

Use this tool to draw a rectangular mask that surrounds the figure as shown in Figure 4.

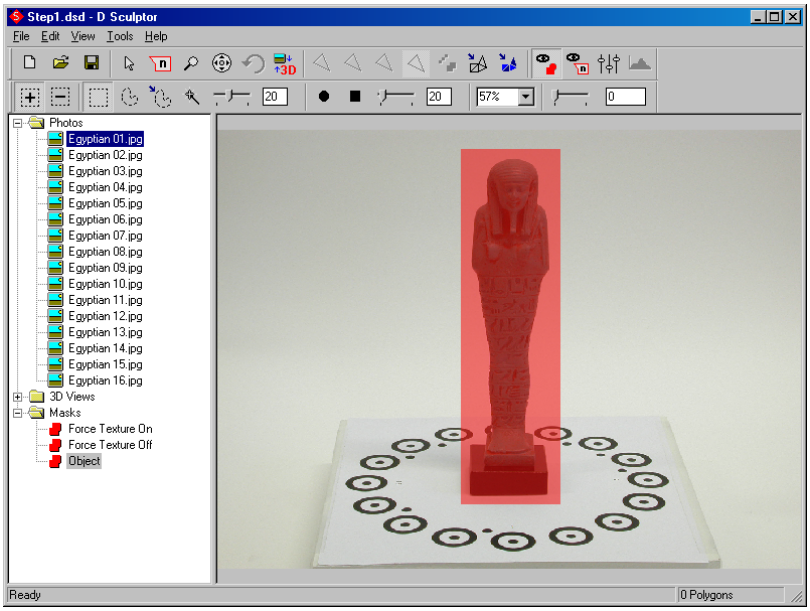

Figure 4: Rough rectangular mask.

The next step is to refine this mask by removing the parts of the mask that don't belong to the object.

Magic Wand

Select the magic wand tool and set the wand sensitivity to 30 by using the wand sensitivity slider or by entering a figure of 30 directly into the wand sensitivity box. Also activate subtractive masking mode by clicking on the Subtractive Mask Mode button.

Using the magic wand tool now click in the masked area but outside of the object. D Sculptor should automatically remove a lot of the background area. After you have used the magic wand tool three or four times, the masked area should look something like Figure 5.

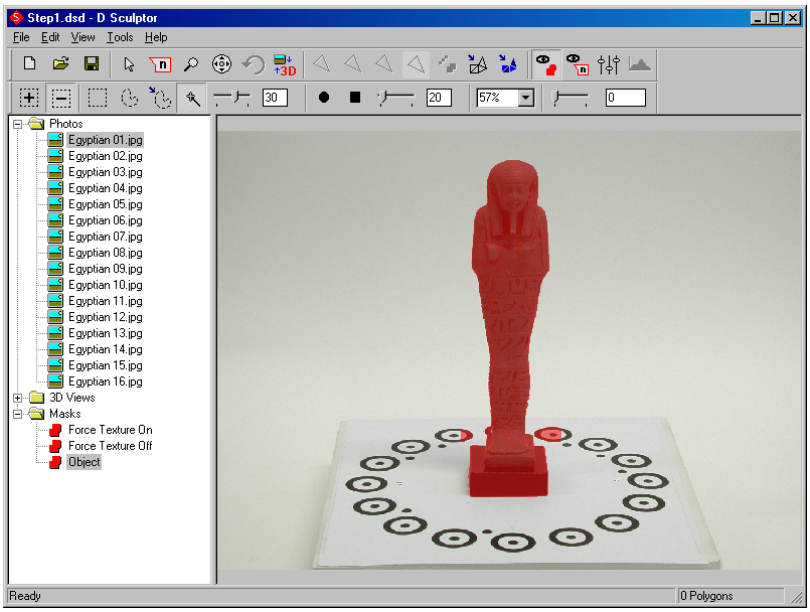

Figure 5: First mask refined.

In this case two of the markers are still partially masked. For the purposes of this tutorial we will also exclude the black pedestal and just model the actual figure itself so we will need to unmask the black pedestal area as well.

To do this zoom in on the area we want to work on. Activate the Zoom Tool by clicking on the Zoom button on the toolbar or by pressing **[F2]** and then zoom in on the area with the partially masked markers and the pedestal as shown in Figure 6

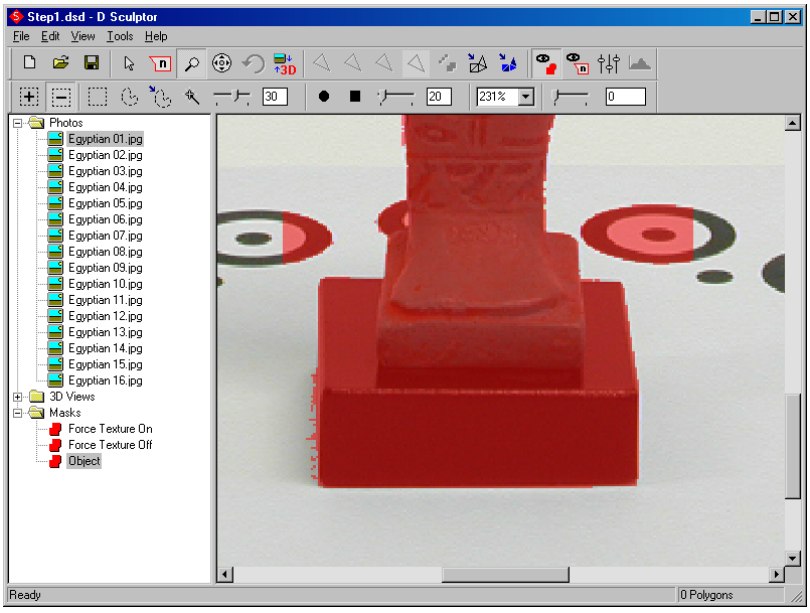

Figure 6: Zoomed in on pedestal.

As we still want to remove parts of the masked area leave D Sculptor in subtractive masking mode.

Round Brush

Select the Round Brush Tool and set a brush size of 20 and use this tool to remove the mask over the pedestal and the markers.

If ever in doubt it is better for the mask to be slightly too large rather than too small so don't remove too much. If you make a mistake you can press **[Control]+[Z]** to undo the last modification you made to the mask.

When you have finished, select Fit Mask on the Zoom drop down or press **[T]** and the screen should look something like Figure 7.

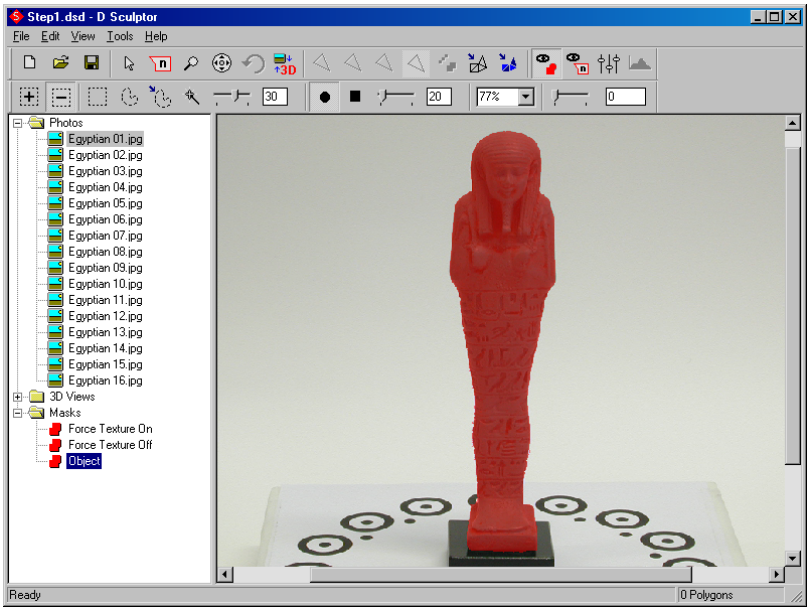

Figure 7: First mask finished.

Having completed the first mask select Egyptian 05.jpg in the project explorer and repeat the process of making a rectangular mask and then refining it with the magic wand and brush tools. If you wish you can also experiment with the Irregular Shape Mask tool when removing the pedestal area.

When you have finished the second mask it should look like Figure 8.

At this point save your work again and call the file MyStep2.dsd.

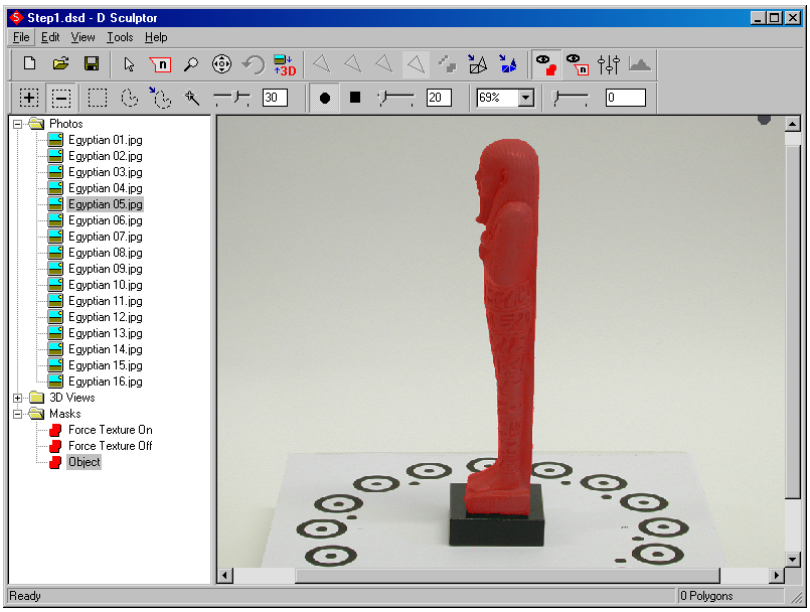

Figure 8: Second mask finished

2.4 GENERATE A MESH

With two masks defined you can calculate a first very simple model. The reason for doing this is that if D Sculptor has such a simple model available then it can make the rest of the masking process even easier.

3D Preview

Before calculating the model this time go to the Egyptian 01.jpg photo by clicking on it in the project explorer. Next switch to 3D mode. You can do this by clicking on the 3D Preview toggle button or by pressing **[Space]**.

Because no model has been calculated yet you should see an empty 3D space with just a grid. Depending on settings it may also have an image of the base plane calibration pattern as used for the photos, as shown in Figure 9.

For now, de-activate the display of the base plane by right clicking over the 3D pane and deselecting **Base plane** on the popup menu (if necessary). Also deselect **Camera positions** on this popup menu.

Generate Mesh

To calculate the first version of the model click on the **Generate Polygon Mesh** button or select **Tools > Generate Mesh**. D Sculptor will show an animation / progress bar while calculating. The time taken to do this calculation will depend on the specifications of your computer as well as the calculation settings (which you can adjust under **Tools > Options > 3D**).

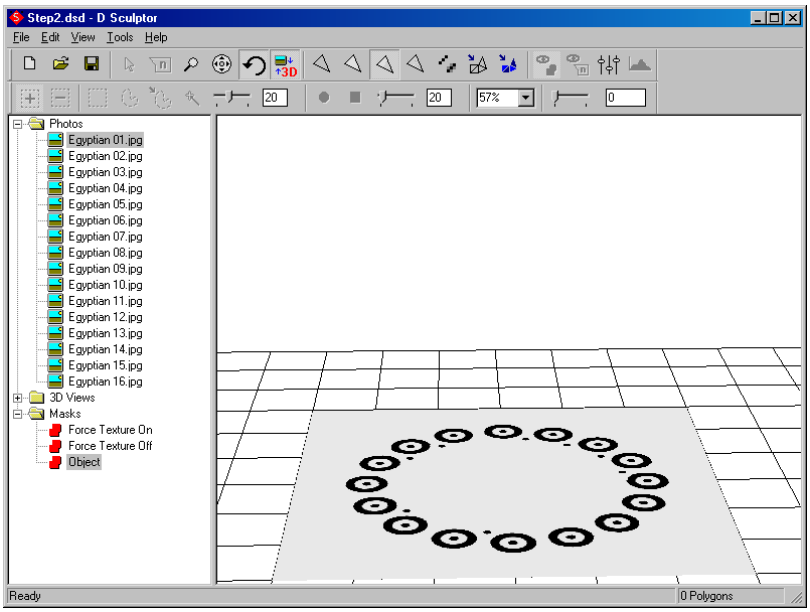

Figure 9: Empty 3D space with grid and base plane shown.

When D Sculptor has finished calculating the workspace should look something like Figure 10.

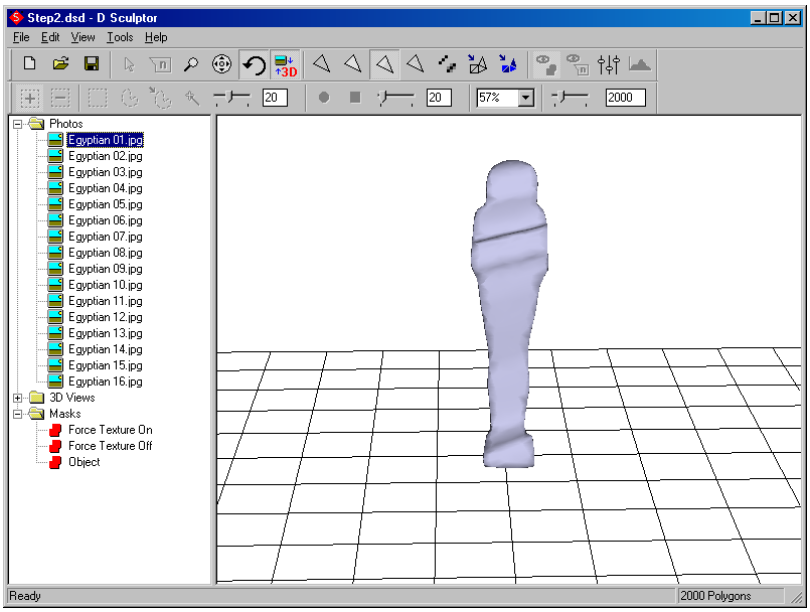

Figure 10: First approximate 3D model.

You can manipulate the model for viewing in 3D mode by dragging the mouse. Depending on whether the **Zoom**, **Pan** or **Rotate** (default) button is selected on the toolbar this should zoom or rotate the model. You can select any of these buttons by clicking on them on the toolbar or by pressing **[F2]**, **[F3]** or **[F4]** respectively.

You can also force zooming or panning while dragging by holding down **[Control]** for zooming or **[Shift]** for panning.

If you have a look at this model from different side you will see that it is very simple and “square-ish”. This is because you have used only two of the sixteen photographs and the model is limited by what D Sculptor

can infer from the front and side views of the object. You can still make good use of this model when masking the other 14 though…

2.5 INITIALISE MASK

To mask the Egyptian 03.jpg photo jump directly to it by clicking on the Egyptian 03.jpg file name in the project explorer, this also activates photo mode without having to use the 3D Preview toggle button.

Initialise Mask

Next click on the **Initialise Mask** button or press **[N]**. Because D Sculptor now knows something about the shape the object it can make an initial guess at the required mask and the masked object should look something like in Figure 11.

As you can see the initial guess is helpful but not yet perfect. You should be able to quickly refine it by using the magic wand and brush tools in subtractive masking mode as before.

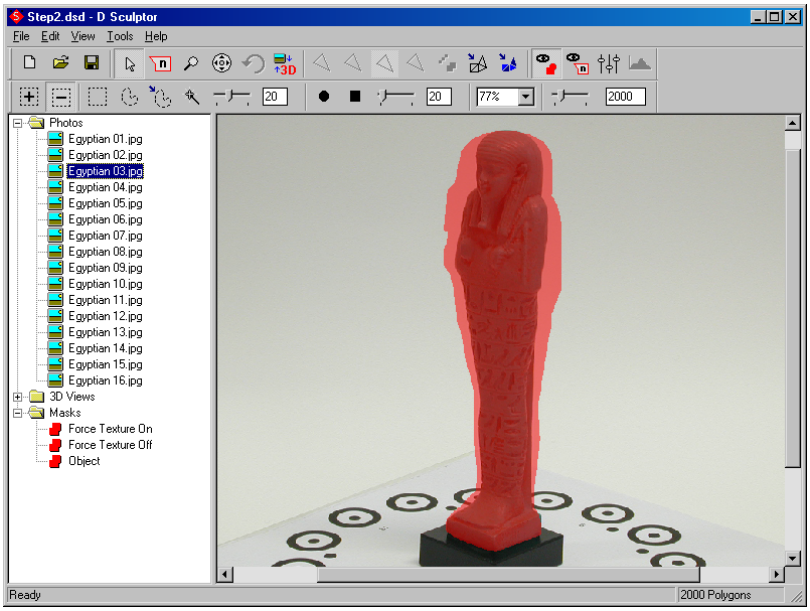

Figure 11: First initialised mask.

Next repeat the process for Egyptian 07.jpg: generate an initial mask and then refine it.

When you have done that you will have masked four photos in total. At this point you can generate the model again. This time just click on the **Generate Mesh** button straight from photo mode. D Sculptor will generate a new mesh and automatically switch to 3D mode when it is finished.

Wire Frame

The new model from four photos should look a lot better than the one generated with two photos. You can also look at the model in flat shaded or in wire frame mode by

- clicking on the Wire frame or Flat shading buttons or
- Pressing **[F5]** or **[F6]** or
- Selecting **View > 3D Rendering > Wire frame** or **View > 3D Rendering > Flat shading**.

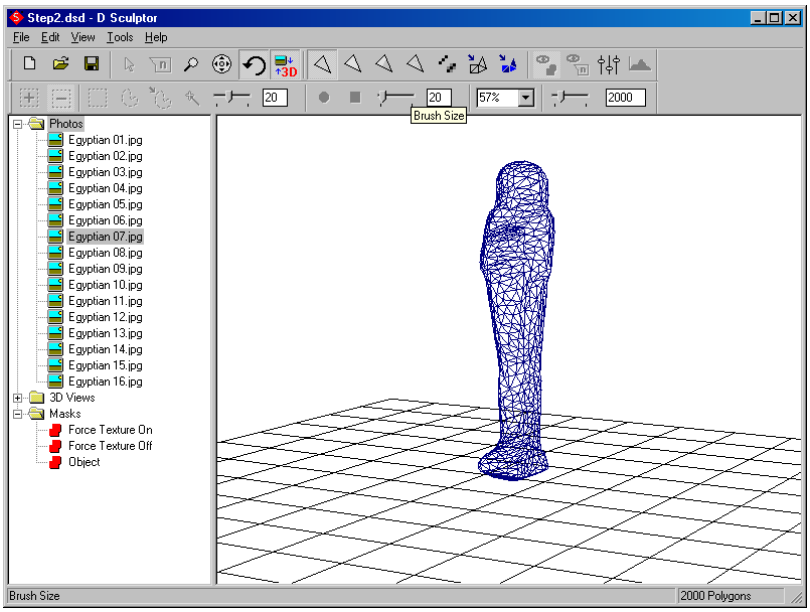

Figure 12: Model from four photos shown as a wireframe.

Figure 12 shows the model at this stage as a wire frame.

Though not yet perfect this model is more than good enough to get started in masking the remaining 12 photographs. Before doing that save the project as MyStep3.dsd.

Next proceed to mask photos 02,04,06 and 08 though to 16 by using the **Initialise Mask** button and then refining the mask using the magic wand tool and the brushes as before.

TIP: use the Toggle Masks button to switch the coloured mask overlay on and off now and then to get a clearer view of the object.

When you have finished doing this click on the **Generate Mesh** button again to calculate the final model shape and save the project as MyStep4.dsd.

2.6 *Adjust Polygon Count*

This final shape should correspond closely to the shape of the actual object. You can vary the number of polygons used in the mesh by dragging the polygon count slider on the toolbar or by directly entering a number in the polygon count box.

Figure 13 shows the mesh at three different polygon counts.

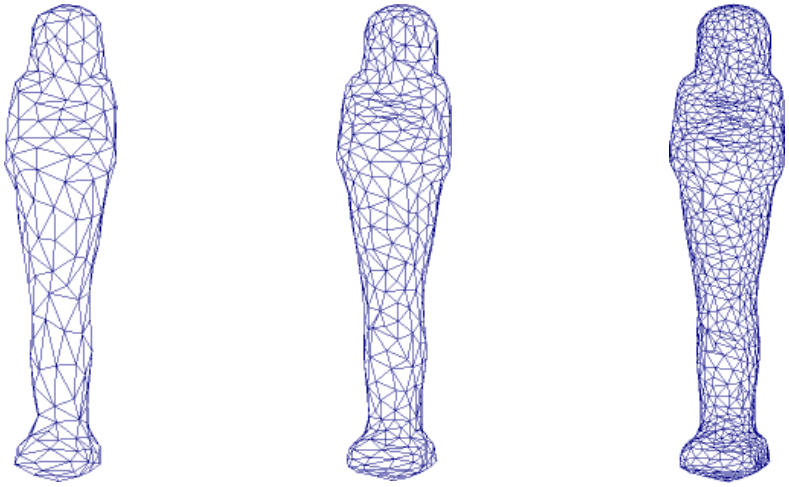

Figure 13: Mesh at different polygon counts.

The optimal number of polygons for the final version of a model depends on the application of this model. High polygon counts give lots of detail but also large files sizes that don't lend themselves well for use on the Internet (long download/ streaming times). Low polygon counts make for compact files that transmit quickly but they may not be as suitable for high quality renderings.

For the purposes of this tutorial set the polygon count to 2500.

2.7 GENERATE A TEXTURE MAP

Generate Texture

All that is now needed to complete the model is a texture map. Click on the **Generate Texture Map** button or select **Tools > Generate Texture Map**. D Sculptor will show its calculation dialog while extracting a texture map and then show you a fully textured model as in Figure 14.

Anti Aliasing

You can manipulate this model for viewing as before. If you want to remove the aliasing (jagged edges) in any view you can click in the **Anti-Aliasing** button or use the **[A]** keyboard shortcut.

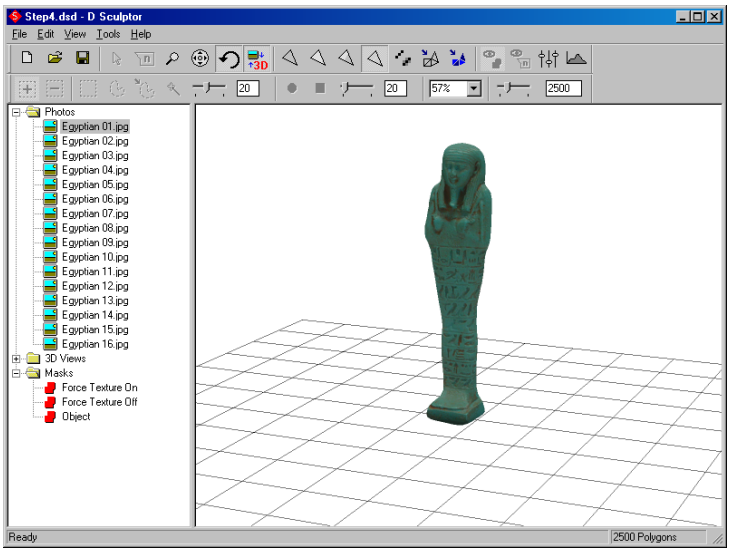

Figure 14: Textured model.

You can enhance the contrast of the texture map by selecting **Tools** > **Texture Map Contrast Enhancement**. This will bring up the contrast enhancement dialog shown in Figure 15.

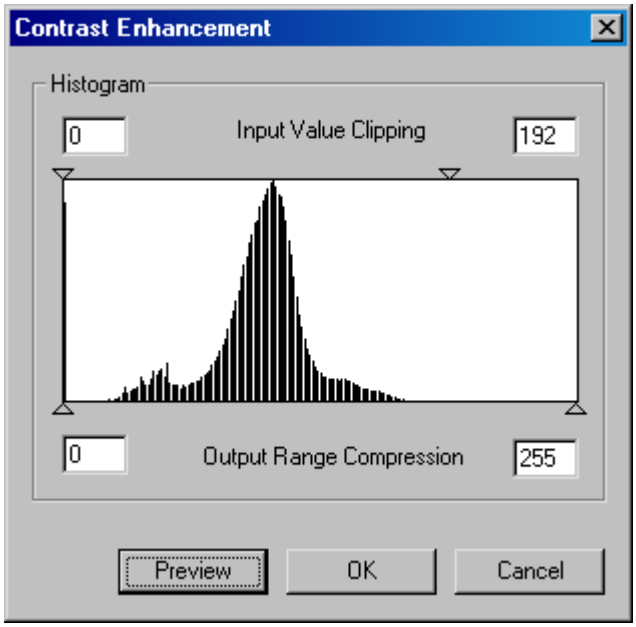

Figure 15: Contrast enhancement dialog.

In this case you can see that the texture map is a little dark (most of the values in the histogram are quite low) and D Sculptor has already suggested an input clipping level. To see what effect this would have click on preview and you will see the change previewed on the model. You can accept this setting by clicking on **OK** or you could drag the triangles at top and bottom of the histogram to change the settings then click **OK** or you can click **Cancel** and leave the texture map as it was. Save the project with the enhanced texture map as MyEgyptian.dsd.

2.8 EXPORT MODEL

As a final step you can export the model. You can do this in formats like .obj and .3ds for use in other software. In this example export the model together with a Java applet for use in a web browser (or over the Internet).

To export in Java (.cjg) format select **File** > **Export** > **Java**. Enter MyEgyptian as a file name and you will be presented with the Java Export Options dialog as shown in Figure 16.

This dialog offers you the option of copying the applet files to the same directory where you are exporting the model. Make sure **Copy applet files** is selected and also tick the **Generate Template HTML file** box to get D Sculptor to generate a simple HTML page. Also tick the **Reduce texture map size to 50%** box.

Click on OK and the model will be exported.

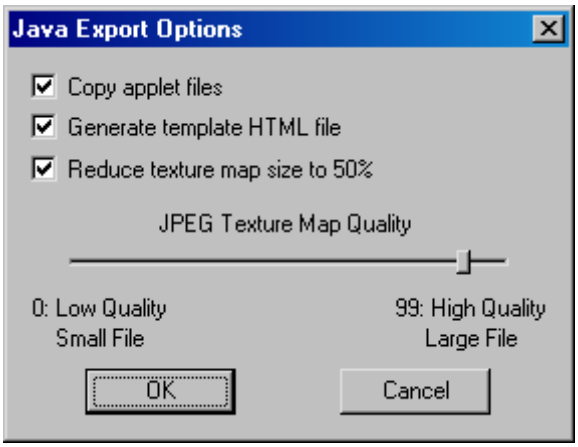

Figure 16: Java Export Options dialog.

If you open the generated MyEgyptian.htm file the model should appear in a browser as in Figure 17.

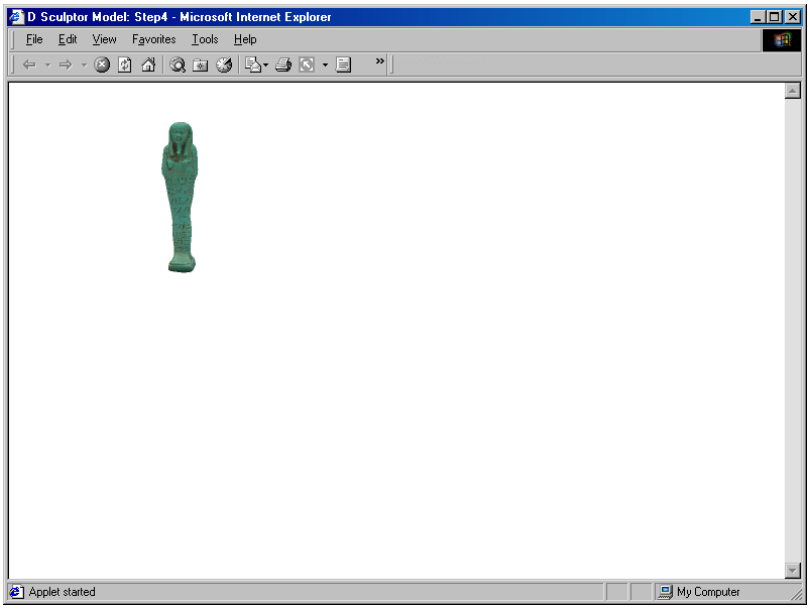

Figure 17: Model shown in a browser.

When viewing the applet you can rotate, zoom and move the model in much the same way as you can in D Sculptor's model mode, by dragging the mouse and pressing **[Control]** or **[Shift]** as appropriate.

For more information on Java export and advanced applet options see Section 4.8.4.

This concludes your first D Sculptor project. You have learned all the basics of using D Sculptor to create a 3D model from photographs. In the next sections of this chapter we will look at some more advanced modelling topics.

2.9 CAMERA POSITIONS

D Sculptor can visualise the camera positions from which the various photos in a project were taken. This can help you better understand what D Sculptor is doing. It is also a useful tool if anything goes wrong with camera calibration as you will easily be able to see what is going on.

Load the supplied Egyptian.dsd from the tutorial directory (if necessary) or use the MyEgyptian.dsd file which you created previously.

Make sure D Sculptor is in 3D mode and right click over the 3D workspace to access the popup menu or select **View > 3D Rendering**.

Switch off display of the **Grid** and switch on display of **Base Plane** and **Camera Positions**.

If you zoom out (drag the mouse towards you while holding down [Control]), and then rotate a little, the workspace should look something like Figure 18.

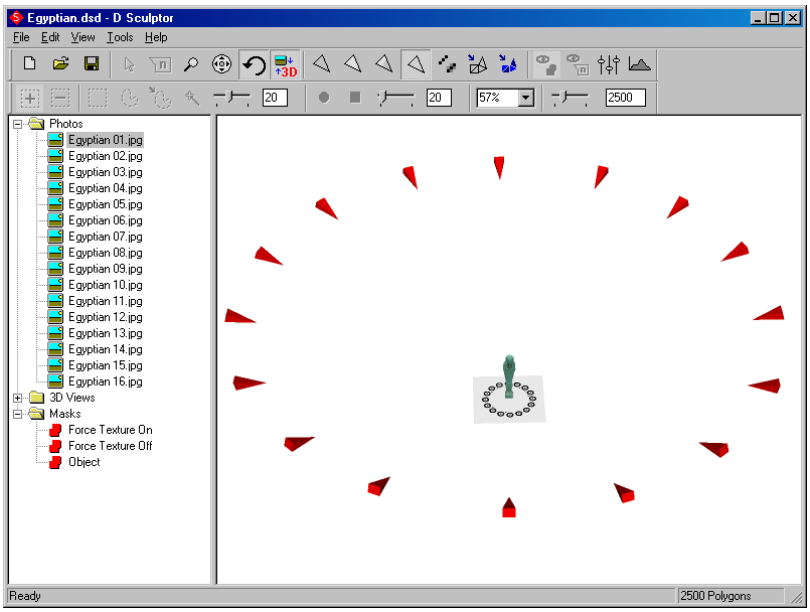

Figure 18: Display of camera positions.

The red pyramid shapes indicate the position, direction and focal length of the cameras used to take the 16 photos in the project.

Right clicking on one of the cameras brings up the camera popup menu. The options on this menu are:

- **Jump to Photo** – select this option and D Sculptor will switch to photo mode presenting you the photo taken from this camera viewpoint.
- **Jump to Camera View** – this option will change the 3D viewpoint to that of the current camera.
- **Highlight Camera texture** – on a textured model displayed with texture mapping turned on this will highlight in red those parts of the model that have had their texture map taken from the photograph taken from this camera position.
- **Clear Highlighted Texture** – this removes the highlight switched on by the previous option.

You may want to experiment a little with these options to get a feel for what they do. They are particularly useful for doing fine-tuning of the

texture map using the Force Texture On and Force Texture Off masks (see also Section 4.3).

2.10 Other Ways of Changing the 3D Viewpoint

Apart from dragging the mouse there are also other ways of changing the viewpoint from which you look at the model.

- If you click on a photo file name in the project explorer D Sculptor will switch to photo mode. Switch back to 3D mode by clicking on the 3D mode toggle button or pressing **[Space]** the 3D view will correspond to the photo you were just looking at.
- If you expand the 3D Views folder in the project explorer you can jump directly to left, right, front, back, top and bottom viewpoints of your model. This even works from photo mode as D Sculptor will automatically switch to 3D mode.
- Instead of using 3D Views folder you can also use the **[F9]**, **[F10]**, **[F11]** and **[F12]** keyboard shortcuts which will make D Sculptor jump to front, left, back and right views respectively.

Try these options to see how they work.

2.11 Multiple Masks

An advanced and extremely powerful feature of D Sculptor 2.0 Professional is that it allows you to work with multiple masks. To see why you might want to do this select **File > Open** and load the …Tutorial\Man\Man.dsd file. This is a model of a small wooden dummy. Examine the model in 3D mode with texture mapping turned on. It should look something like Figure 19.

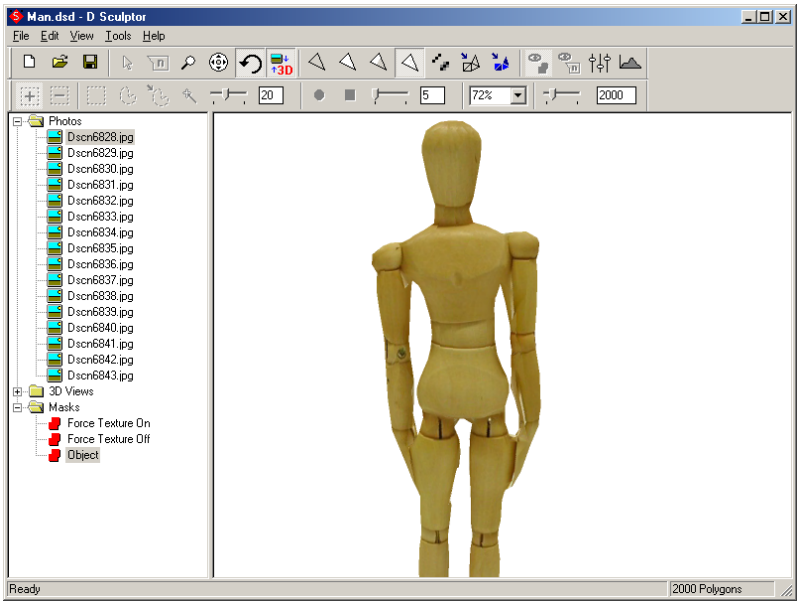

Figure 19: Wooden dummy modelled with one mask.

If you rotate the model a little you will see that there are problem areas around the arms and legs of the model.

The reason for this is that in the photos used to make this model the edges of the arms are often obscured by the torso or vice versa.

Similarly the legs partially obscure each other in several photographs. Figure 20 shows an example.

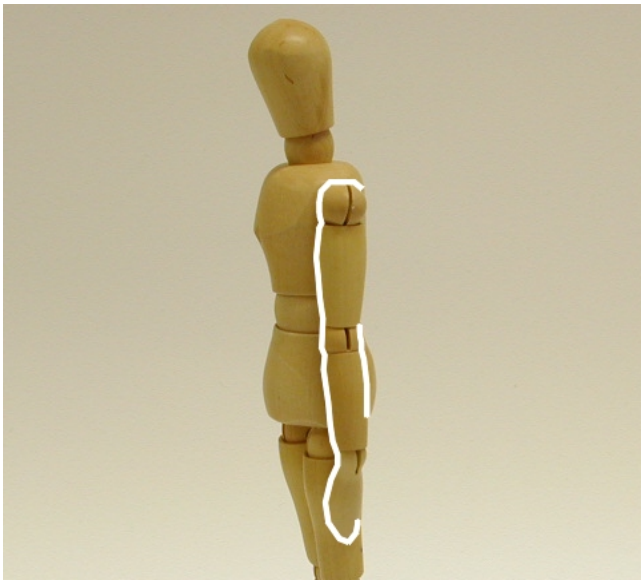

Figure 20: Outlined arm.

The outline of the left arm (shown in white) provides additional information which we haven't been able to use with the techniques learned so far.

One approach might be to take more photos from different viewpoints but D Sculptor 2.0 Professional offers another solution: multiple masks.

Load …Tutorial\Man\Man2.dsd and examine the textured model in 3D mode. You will see that the shape is now much better defined while the photos used are exactly the same ones as in the previous project. The improved results were achieved using multiple masks. Look at the Masks section of the project explorer and you will see that there are five object masks defined: Torso+head, Left arm, Right arm, Left leg, Right leg. As each of these masks refers to an individual sub-object it is possible to use all visible edges to define them. When D Sculptor calculates the final model it merges the five individual objects together to form one large object.

If you like you can reload …Tutorial\Man\Man.dsd and convert it to a multiple mask project for yourself (see also Section 4.3). In doing this (as well as in general) we would suggest keeping the following things in mind.

- Start by modelling the object as a whole. In this way you can quickly see if there are any potential problem areas and if so where they are.
- When you add a sub-object mask you will also have to "cut this sub-object off" in the main mask you started with. You need only do this in one (well chosen) photo but you might want to do it in more than one photo if it allows you to add more outline information for the remaining object.

- Add the sub-objects one by one. Finish each one before you start on another. When modelling a sub-object make sure that its mask is the only one set “Active”. When you have completed the sub-object you may want to temporarily set all masks to active and generate a mesh to view progress before starting on the next sub-object.
- When masking the sub-object remember that you can use the Initialise Mask function as before. This greatly speeds the process and it aids clarity.
- If in doubt whether to cut something off or not (make the mask smaller) then don’t do it. If you cut something off by accident in one photo then it will not be included in the model, even if it is not cut off in any remaining masks.

2.12 Force Texture Masks

In …Tutorial\Man\Man2.dsd you can also see an example of the use of one of the two special texture masks.

If you select and photo Dscn6838.jpg in the project explorer and you make the Force Texture Off mask visible by clicking on it in the Masks section of the project explorer then you should see a workspace much as in Figure 21.

The Force Texture Off Mask has been used to mask off part of the metal supporting rod where it obscures the left leg. This instructs D Sculptor to avoid introducing this metal into the texture map if it possibly can.

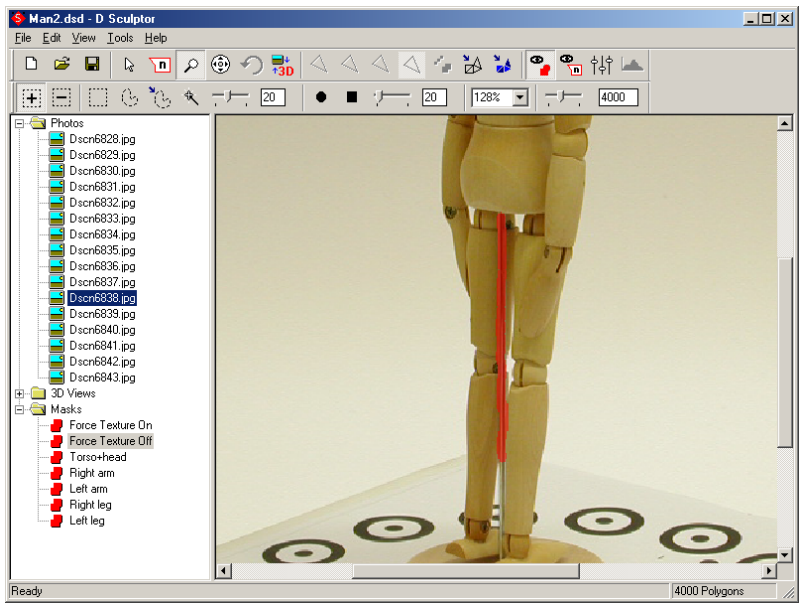

Figure 21: Example of use of Force Texture Off mask.

The extent to which D Sculptor can successfully do this of course depends on whether it can find suitable texture in other photos and on the polygon count (and hence polygon size) of the final model.

The Force Texture On mask which is not used in this project has the opposite effect. If an area in a photo is marked with this mask then D Sculptor will try to use it for texturing.

2.13 PROJECT MERGING

Another powerful D Sculptor 2.0 Professional feature is project merging: merging two separate projects (of the same object) together to be able to model it from all sides and get improved shape fidelity.

Load the project …Tutorial\Phone\phone_vertical.dsd. Examine the model in 3D mode. You will see that it is quite a good model of a mobile phone. The only problem with this model is that the underside of the phone hasn't been properly textured because it isn't visible in the photos and it can't be because the model has to stand on the pattern.

In situations like this D Sculptor will interpolate a texture for such invisible areas. The result is illustrated in Figure 22.

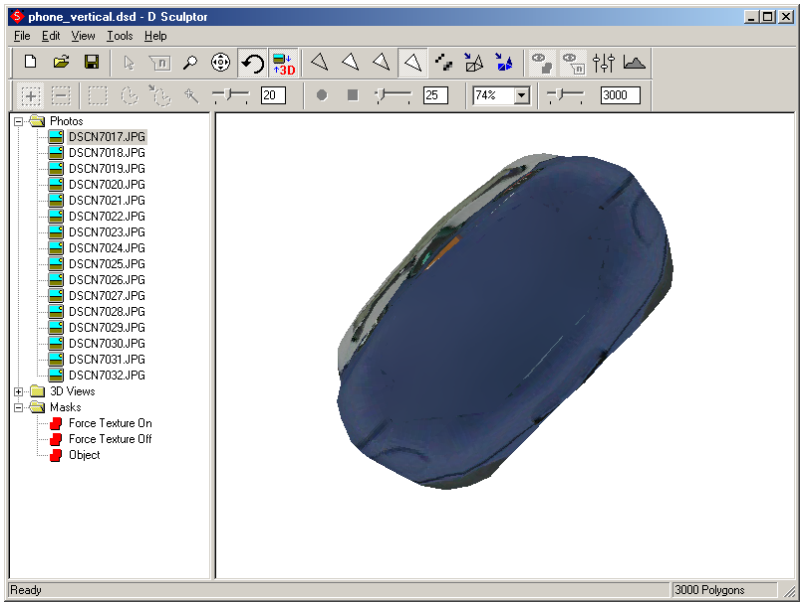

Figure 22: Interpolated texture on bottom of phone.

In many cases this is perfectly acceptable but sometimes you may need to model from all around…

Next load the project …Tutorial\Phone\phone_horizontal.dsd. This project has a clear view of the bottom of the phone but because of the angle of the photographs the back cannot be modelled and the shape of the front cannot be properly captured.

You can however merge this project with the previous in order to have all views available. In order to be able to do this you will need to add some additional markers known as merge markers to each project. These markers help D Sculptor work out the relative orientations of the two projects.

You will need to add *at least three* merge markers to *at least two* of the photos in each project. To see an example load …Tutorial\Phone\phone_vertical_m.dsd and have a look at photo

Dscn7019.jpg in photo mode (with the Toggle Markers button turned on and the Toggle Masks button turned off).

You will see that in addition to the normal pattern markers there are now also a number of markers on the phone itself, each with a little "M" in the lower right corner to show that these are merge markers.

Merge markers 1 and 2 are at the top left and bottom left of the phone display screen. Merge marker 3 is invisible in this photo. Merge markers 4 and 5 are at the top right and bottom right of the phone screen while marker 6 is at the top of the slit on the bottom right side of the phone. The situation is illustrated in Figure 23.

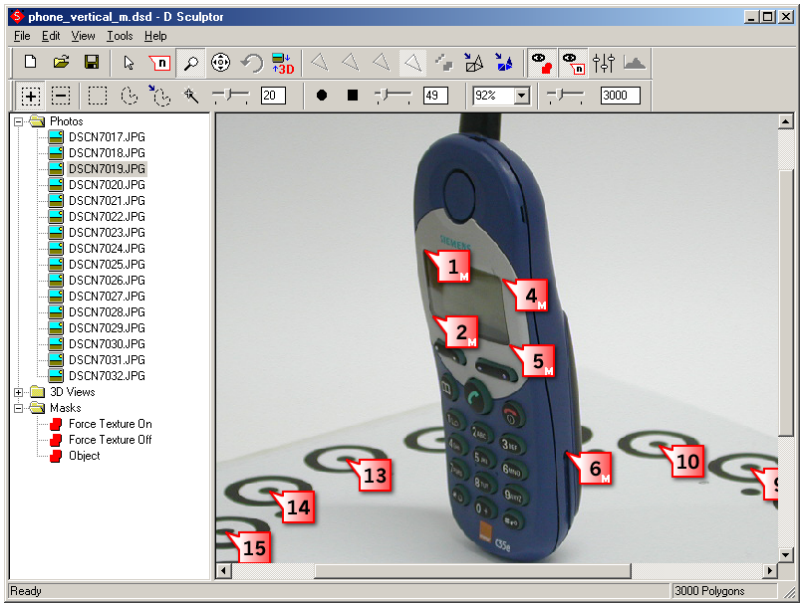

Figure 23: Example of inserted merge markers.

If you look in photos 7020 and 7030…7032 you will see the same points marked out, with 7030…7032 showing merge marker 3 and not merge marker 6 (as these show the left side of the phone as in Figure 24).

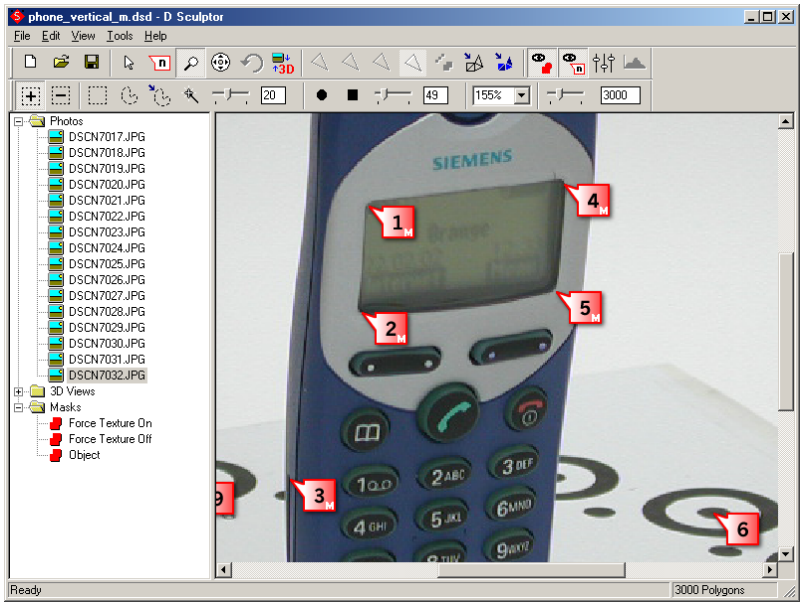

Figure 24: Merge markers in different photo.

You will find more information on inserting and renumbering (merge) markers in Section 4.2.2. For the purposes of this example we have inserted matching markers in a couple of the photos of the …Tutorial\Phone\phone_horizontal_m.dsd file so let's merge that one with this one…

Select **File > Merge** and select the phone_horizontal_m.dsd file for merging and click on OK once you have selected it.

Switch to 3D mode and zoom out a little. Make sure display of camera positions is turned on. You should see something like Figure 25.

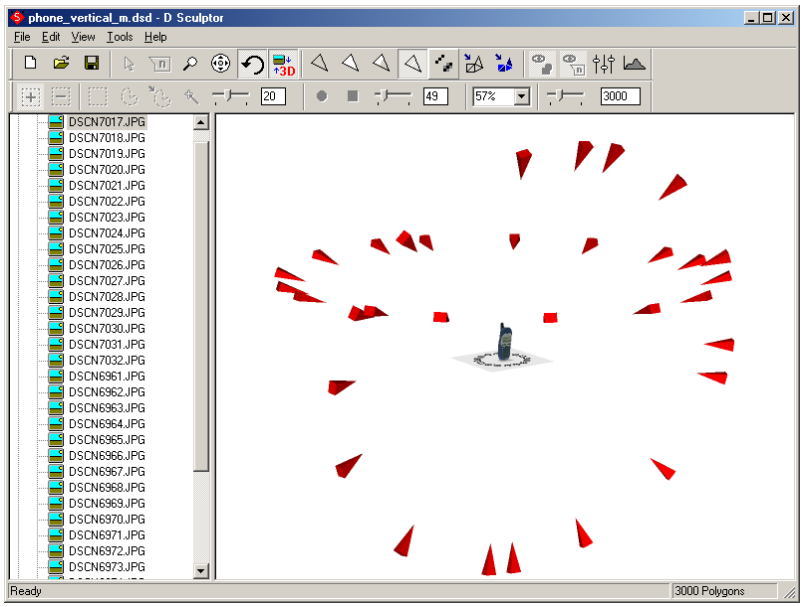

Figure 25: Merged projects.

All 32 photos and resulting camera positions are now included in the project so there is no reason why we can't model all sides of the phone.

Generate a new mesh and after doing that reduce the polygon count to 3000 or so (if necessary). Then generate a texture map and save the resulting project as my_phone_merged.dsd.

The phone is now modelled from all sides. If you wish you can further tweak the texture map by using the Force Texture On and Force Texture off masks as appropriate (Force Texture On has already been applied for the front of the phone for photo Dscn7017.jpg).

Note that using multiple projects like this not only allows you to model all sides but it also improves the fidelity of the modelled shape. This is because the number of photos is larger and the range of angles from which these photos are taken is much more diverse.

3 MODELLING IN D SCULPTOR

To get the best results out of D Sculptor there are a number of things that you can do before using the actual software, while setting up and planning your project and while taking the photos for your project.

3.1 PLANNING YOUR PROJECT

The marker pattern can be any size you like. It makes sense to match the size of the marker pattern to the size of the object you want to model. Ideally the object to be modelled should fill most of the area of the marker pattern but not actually be so large as to overlap any of the markers.

When setting your object on the marker pattern verify that the object isn't higher than twice the diameter of the marker pattern circle. If it is higher then you need to use a larger marker pattern or D Sculptor will cut off the top of the object.

D Sculptor assumes the object to be modelled to be at rest with respect to the marker pattern so the object should not move or move as little as possible. When using live objects, try to avoid object movement and take the photos as quickly as possible. A fast camera (or even multiple cameras) can help.

When the shape or the texture map does not look right, try taking more pictures. Errors in shape can induce errors in the texture map. The shape may be wrong because not enough photos were used. More photos will usually give a more accurate approximation of the object shape.

Start modelling an object with a low number of photos (10-16) and add photos later on when it becomes clearer where additional photos need to be taken from.

If pointing markers out manually always point out all the visible markers in each photo, not just a few. Using more markers leads to more accurate models.

3.2 TAKING GOOD PHOTOS

When making photos for use in D Sculptor projects there are a number of things that you can do in order to improve the quality of the results or to work more efficiently.

Using higher quality pictures will give higher quality models. Try to use the highest quality setting on the camera and make sure that the object is in focus.

High resolution photos (3 mega-pixels or more) can lead to better modelling accuracy and they also contribute to good high resolution texture maps. However they are by no means necessary for good results. A well exposed and well framed 1 mega-pixel photo will give better results than an indifferent 3 mega-pixel photo.

If the computer used has a small memory (less than 128 MB), try not to use very high-resolution photos.

Frame the photos in such a way that the modelled object and the marker pattern it rests on use up as much of the frame as possible but do be careful that no markers or pieces of the object are cut off at the edges of the frame.

Try to avoid specular highlights (direct reflections from shiny objects), these can give problems for texture mapping. One way to get rid of all specular highlights is to use a combination of a linear polarising filter in front of the light source(s) and an orthogonal linear polarising filter in front of the camera lens.

Don't make photos with the camera pointing straight down onto the marker pattern or with the camera at a very small angle and low height with respect to the marker pattern. D Sculptor may not be able to determine camera position from the marker positions in such cases.

Ideally the angle of elevation of the camera (α in Figure 26) should be between 15 and 70 degrees.

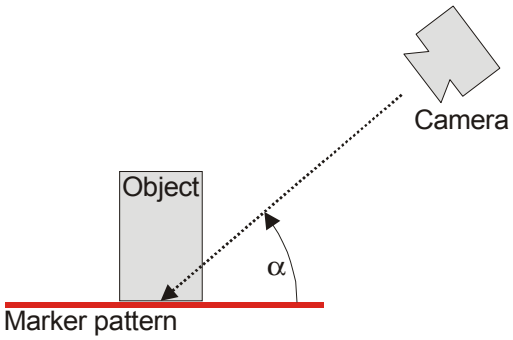

Figure 26: Camera elevation.

After taking the photographs, leave the object on the marker pattern so that additional photos can still be taken if it turns out you have too few. Once the object has been removed from the marker pattern, it will be nearly impossible to get the object in exactly the same position on the marker pattern. As D Sculptor requires the object to be in a fixed position with regard to the marker pattern it will then not be possible to shoot additional photos for your project.

For a photo to be valid an uninterrupted string of at least 7 markers should be cleanly visible at the front of the object. In other words make sure the object to be modelled falls completely within the marker pattern and it doesn't cover any of the markers.

3.3 THE MARKER PATTERN

The marker pattern used in D Sculptor is shown in Figure 27. You can print it out straight from D Sculptor by selecting **File > Print Calibration Pattern**. It is also supplied in a number of different file formats with the program so that you can print copies off for yourself. Depending on installation these files can usually be found in …Program Files\D Vision Works\D Sculptor\Patterns\ so that you can print them as required.

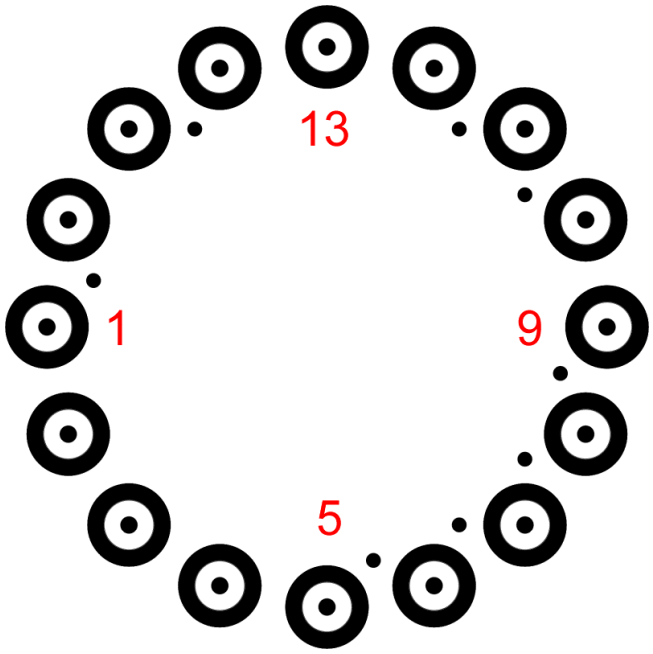

Figure 27: Circular marker pattern.

When printing producing a marker pattern to model a particular object keep the relevant points noted in Section 3.2 in mind. Also when using this pattern have the front of the modelled object face marker number 1, the various items in the 3D Views folder of the project explorer will then correspond with the actual front, right, etc. of the object.

3.3.1 Square Marker Pattern

It is also possible use a square marker pattern (as shown in Figure 28). To do this tick the square marker pattern radio box under **Tools** > **Options** > **Photograph**.

In this case it is best for the front of the object to face marker number 3 (the middle of the front side of the square).

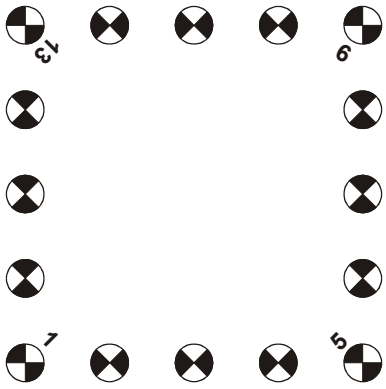

Figure 28: The marker pattern

Square marker patterns provide backward compatibility with D Sculptor 1.0 projects.

Square marker patterns are useful in situations where you might wish to make patterns of your own, for instance if a very large pattern is required or you want to make a pattern round a large outdoors object.

You do not have to use quartered circle markers as in Figure 28, any mark you can indicate the centre of will do. The points to observe when making your own pattern are:

- The 16 markers are arranged in a square, on a flat surface. It is important that this surface should be flat because D Sculptor assumes the markers to all be in the same plane.
- The distance between two subsequent markers is 1/4 of the width of the edge of the square.
- The markers are numbered anti-clockwise with the corner points being numbered 1, 5, 9 and 13.

This gives you great flexibility in the construction of marker patterns. The disadvantage is that D Sculptor *cannot automatically detect square marker patterns* and you will have to manually enter these markers. As this takes less than a minute per photo it need not be a great disadvantage.

4 REFERENCE

This section is lists a number of basic D Sculptor procedures as well as providing more detailed information on the D Sculptor marker pattern and the D Sculptor applets.

4.1 PHOTOS

In Photo Mode photos can be inserted into a project by selecting **File > Insert Photos**. If there are already some photos in the project then you can also right-click on an existing photo and select **Insert Photos…** from the popup menu.

Any particular photo can be removed from the project by selecting **File > Remove Photo** or by right clicking on the photo in the project explorer and selecting **Delete** from the popup menu.

You can navigate through the photos by clicking on a photo name in the project explorer. Even if D Sculptor is in 3D mode it will switch to photo mode before displaying the requested photo.

To get details on any particular photo right click on the photo name in the project explorer and select **Properties** from the popup menu. D Sculptor will display details about the photo including camera calibration information if this is available.

Photos for which calibration for which D Sculptor has already determined the camera position show up in the project explorer with coloured icons while photos for which this information has yet to be determined are shown with a black and white icon next to them.

4.2 CALIBRATION MARKERS

In most situations calibration markers are detected automatically but it is also possible to manually insert/edit markers in D Sculptor.

4.2.1 Automatic Marker Detection

D Sculptor can normally automatically detect the markers on the calibration pattern. To have D Sculptor do this you can:

- Select **Tools > Find Markers in Photo** *or*
- Use the **[Ctrl]+F** keyboard shortcut

D Sculptor should find all visibile markers in a few seconds.

It is also possible to have D Sculptor find the markers in all the photographs in your project. To do this select **Tools > Find Markers in all Photos**.

4.2.2 Manual Marker Editing

If you wish you can also manually insert the markers. While the marker tool is active (in Photo Mode) clicking on a point inserts a marker. To delete the last marker entered press **[Delete]**. In order to delete a larger number of markers activate the Selection Tool and drag a selection box round the markers you wish to delete and then press

[Delete]. You can also select several groups in sequence by holding down **[Control]** while selecting in the usual Windows fashion.

If you are inserting markers at a high zoom setting it is possible to pan between markers with the Marker tool still active. Just hold down [Shift] and drag the mouse. As soon as you release [Shift] the cursor reverts to the Marker tool cursor.

To renumber a marker move the cursor over the marker and right click. A pop-up menu will appear listing all free marker numbers. Click on the appropriate one to renumber the marker.

Note that (normal) markers 1 to 16 are intended to mark point on the calibration marker pattern while merge markers 1 to 16 are used as references for project merging (see Section 2.13).

To move a marker activate the Selection Tool, left click with the cursor over the marker to be moved and drag the mouse to move the marker.

4.2.3 Printing a Marker Pattern

To print a marker pattern on your printer select **File > Print Calibration Pattern**. For more information on the marker pattern see Section 3.3.

4.3 MASKING

Masking is done with the tools on the bottom toolbar. You can select which mask you are working on in the Masks folder of the project explorer.

- The “Force Texture On” mask indicates areas in the photo that you definitely want to be used to provide texture information for relevant areas on the model.
- Conversely the “Force Texture Off” mask indicates areas in the photo that you do not want to be used to provide texture information for the model.

All other masks are object masks. Many models will have only one object mask (to mask the shape of the whole object) while very complex models may have a number of object masks to describe different parts of the shape (Professional version only).

You can select which mask to work on by clicking on it in the project explorer. If you need to create a new object mask first you can do so by right clicking anywhere in the mask area of the project explorer and selecting **Insert Mask** from the popup menu.

Right clicking on an object mask in the project explorer brings up the Mask Properties dialog box which allows you to set the mask’s name and declare whether it is Active and/or positive.

If a mask is set as active it will be included in the modelling process next time a mesh is generated. If it is not then the mask will be ignored. If a mask is set as positive the shape that it helps define will be added to the modelled object. If it is negative then this shape will be subtracted or cut away from the object.

Most mask operations either *add to* or *subtract from* the mask you are working on. You can select additive or subtractive masking mode by clicking on the Additive Mask Mode or Subtractive Mask Mode buttons or by pressing **[+]** or **[-]**.

To manually add to or remove from the mask you are working on you can use a variety of tools. These all have buttons on the bottom toolbar as well as keyboard shortcuts.

- The Rectangular Mask tool operates on rectangular areas, the keyboard shortcut for this tool is **[R]**. Click on one corner of the area and drag the mouse. Release the mouse over the opposite corner of the area.
- The Irregular Shape Mask Tool (**[K]**) operates on masks of arbitrary shape. Click on a point along the edge of the desired area. As you click on subsequent points you will see the shape of the mask start to build up. Double click the last point of the area shape and the area will be added to or deleted from the current mask as required.
- The Round Brush Mask Tool (**[P]**) provides a brush that you can use to work on the mask. With the tool active simply drag the mouse where you want to make changes. You can change the size of the brush by using the slider just to the right of the brush tools.
- The Square Brush Mask Tool (**[R]**) works like the Round Brush Mask Tool except that the brush is square.
- The Magic Wand Mask Tool (**[W]**) selects areas of similar colour. With this tool activated click somewhere and the tool will select an area of similar colour round that point. The slider to the right of the Magic Wand Mask Tool adjusts the similarity tolerance. If this value is set low then the tool will select only very similar colours and probably only a small area. If this value is set high then the tool will select more approximately similar colours and a larger area.

D Sculptor also has an automatic mask initialisation tool. Once you have masked a few photos you can get D Sculptor to generate an initial mesh. D Sculptor can use this mesh information to make an initial guess at the mask for additional or new photos. To get it to do this just:

- click on the Initialise Mask button *or*
- select **Tools > Initialise Mask from Mesh** *or*
- use the **[N]** keyboard shortcut.

To make best use of this feature you shouldn't necessarily mask the photos in the order in which you shot them as you want D Sculptor to quickly develop an idea of the rough outline of the shape to be modelled so usually it is best to adopt a strategy like in the tutorial in section 2, e.g:

1. Mask a front and a side view and generate a mesh.
2. Mask two diagonal views (using Initialise Mask if you like) and generate a mesh.

3. Mask all remaining views using Initialise mask to help speed things.

4.4 GENERATING A MODEL

When two or more photos have had markers inserted and object masks outlined you can generate a mesh by clicking on the Generate Mesh button or selecting **Tools > Generate Mesh**. This mesh will be generated according to the options set under the **Mesh** tab under **Tools > Options**.

When the mesh has been calculated you can fine-tune the number of triangles by dragging the Polygon Count Slider. Please note that you cannot ask for a polygon count higher than the one at which the model was generated or saved.

To add a texture map to the mesh click on the Generate Texture Map button or select **Tools > Generate Texture Map**.

If you wish it is possible generate a model several times as you go along during a project: insert a few photos, insert markers and outlines, switch to 3D Mode and generate a mesh and a texture map to see how thing are coming along then switch back to Photo Mode, add more photos, etc… See also section 4.3 on the use of the Initialise Mask function.

4.5 EXAMINING THE MODEL

To switch to 3D mode from Photo mode:

- click on the 3D Preview button *or*
- use the [SPACE] keyboard shortcut
- click on one of the 3D views in the project explorer *or*
- use the [F9], [F10], [F11] and [F12] shortcuts to jump directly to a front, left, back or right view.

When a model is displayed in 3D mode you can manipulate the model for viewing by dragging the mouse. Depending on whether the **Zoom**, **Pan** or **Rotate** (default) button is selected on the toolbar this should zoom or rotate the model. You can select any of these buttons by clicking on them on the toolbar or by pressing **[F2]**, **[F3]** or **[F4]** respectively.

You can also force zooming or panning while dragging by holding down **[Control]** for zooming or **[Shift]** for panning.

4.5.1 Rendering Modes

You can also view your model rendered in a variety of different ways. Clicking on the Wire frame (**[F5]**), Flat Shading (**[F6]**)and Smooth Shading (**[F7]**) buttons on the toolbar will show you the effects of the various rendering modes. If there is a texture map available you can also click on the Texture Mapping button (**[F8]**) to display a texture mapped rendering.

These rendering modes can also be selected by right clicking anywhere over the 3D rendering and selecting **Wire frame**, **Flat Shading**, **Smooth**

Shading or **Texture Mapping** from the popup menu. These same options can also be found under **View > 3D Rendering**.

4.5.2 Camera positions

If the **Camera Positions** option is enabled on the main 3D mode popup menu you will be able to see camera position and orientation for the various calibrated photos in the project represented as pyramid shapes (you may have to zoom out a little). If you right click on one of the camera position indicators you will see the camera position popup menu. If you select **Highlight Camera Texture** on this menu then D Sculptor will highlight, in red, the texture triangles on the model that have had their texture extracted from this photograph (except in Wire frame display). Selecting **Jump to Photo** from the camera position popup menu will switch D Sculptor to photo mode, with the photo from the relevant camera loaded.

4.5.3 Backgrounds

It is possible to set a background image for 3D mode. To do this select **File > Background > Load Image**. After selecting a file you will be asked whether you want to tile or stretch this image in the background. Once you have chosen and clicked **OK** the image will appear in the background in 3D mode.

To remove the background image select **File > Background > Clear**.

4.6 *MANIPULATING THE TEXTURE MAP*

Once D Sculptor has generated a texture map for a model (possibly making use of the Force Texture On and Force Texture Off masks to get the best possible result) you can re-size the texture map or do contrast enhancement on it within D Sculptor. If you should want to manipulate the texture map in external texture editors such as Deep Paint 3D D Sculptor also allows you to export and re-import the model.

4.6.1 Resizing the texture map

In order to resize the texture map select **Tools > Resize Texture Map**. You will see the Resize Texture Map dialog box of Figure 29. Here you can enter the desired texture map dimensions.

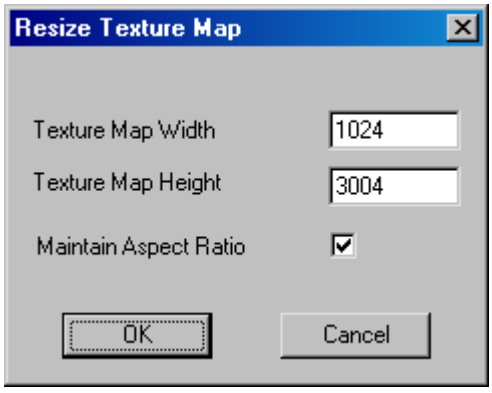

Figure 29: Resize Texture Map dialog.

If you want D Sculptor to automatically maintain the height to width ratio of the texture map then keep the Maintain Aspect Ratio box checked.

4.6.2 Enhancing the contrast of the texture map

To perform contrast enhancement on the model texture map select **Tools > Texture Map Contrast Enhancement**. You will see the contrast enhancement dialog box of Figure 30.

You can set the contrast enhancement parameters by moving the triangular pointers at the top and bottom of the histogram. To preview the contrast enhanced texture map on the model click on the **Preview** button. Once you have finalised the contrast enhancement parameters click on **OK** to accept them or **Cancel** to stop the operation and return the texture map to it's original state.

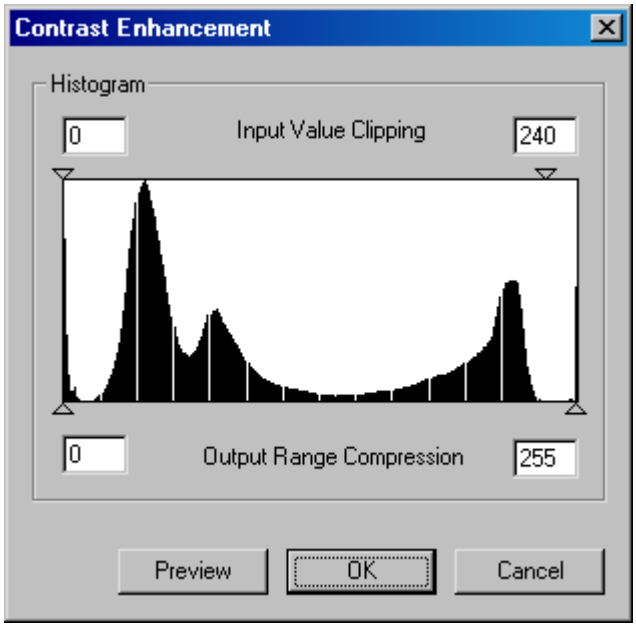

Figure 30: Texture Map Contrast Enhancement dialog.

4.6.3 Importing Wavefront files

Sometimes you may want to modify a texture map in a specialised third party texture map manipulation package like Deep Paint 3D and then to export it in one of D Sculptor's export formats. To do this:

- Export the model as a Wavefront (.obj) file
- Manipulate this model (texture map) in your external editing package
- Re-import the modified Wavefront model into D Sculptor using the **Import Wavefront** entry in the **Import** section of the **File** menu.

4.7 *Auto Generating Photos*

There are two situations in which you might want D Sculptor to automatically generate a photo from a Model Mode view:

- You are short of a photo with the right perspective to cut off a protrusion on the model.
- You want to apply a texture of your own making to a part of the model and you require a photo from just the right perspective (so you can easily manipulate it in an external bitmap editor).

In both cases just move the model in 3D mode to give the right perspective and then select **Tools > Generate Photo** from the menu. A photo corresponding this perspective will be added as the last photo in the project. To see it just click on the last photo name in the project explorer. There is no need to enter or find markers in auto generated photos like this because D Sculptor already knows the camera position.

4.8 EXPORTING D SCULPTOR MODELS

To export a model from D Sculptor select the appropriate option from the popup submenu that appears when you select **File > Export**.

4.8.1 3D Studio Export

After entering a file name the JPEG quality dialog box shown in Figure 31 will appear and you can set a JPEG quality factor for the exported texture map. Lower values results in smaller file size and reduced quality while higher values give larger file size and better quality.

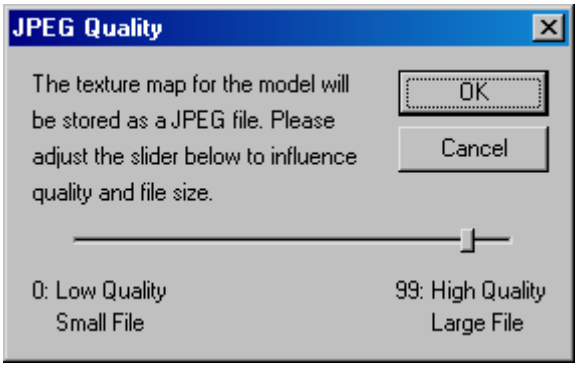
JPEG Quality
The texture map for the model will be stored as a JPEG file. Please adjust the slider below to influence quality and file size.
OK
Cancel
0: Low Quality
Small File
99: High Quality
Large File

Figure 31: JPEG quality dialog.

After you have set a JPEG quality factor you can click on **OK** and the model will be exported in .3ds format.

4.8.2 Direct 3D Export

To export in Direct 3D format select **File > Export > Direct 3**. After entering a file name in the Save As dialog box the model will be exported in .x format.

4.8.3 DXF Export

To export in DXF (.dxf) format select **File > Export > DXF**. After entering a file name in the Save As dialog box the model will be exported in .dxf format. Exported DXF models are wire frame only and have no texture maps.

4.8.4 Java Export

D Sculptor also allows you to export models in a proprietary compressed format along with a Java applet for viewing these models.

This means that you can publish your models to the Internet in such a way that they can be viewed on a wide variety of Java capable platforms with fast streaming downloads.

To export in Java (.cjg) format select **File > Export > Java**. After entering a file name in the Save As dialog box you will be presented with the Java Export Options dialog as shown in Figure 32.

This dialog offers you the option of copying the applet files to the same directory where you are exporting the model. You should select this option unless the applet files are already present there. If you want D Sculptor to generate a template HTML file then you should also select that option.

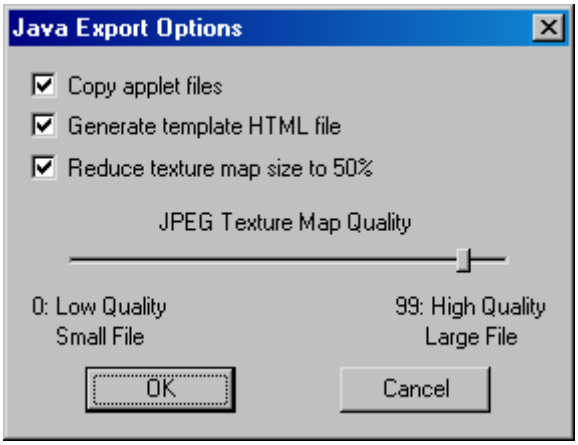

Figure 32: Java Export Options dialog.

Also you are offered the option of reducing the model texture map size by 50%. Usually it is best to do this in order to speed model download times as well as to improve compatibility with older web browsers and Java virtual machines.

When viewing the applet you can rotate, zoom and move the model in much the same way as you can in D Sculptor's model mode, by dragging the mouse and pressing **[Control]** or **[Shift]** as appropriate.

To use the applet on HTML pages of your own you will need to insert code similar to that shown below:

```
<applet code=view3d.class name=view3d width=320 height=200>
<param name=Model value="mymodel.cjg">
<param name=Texture value="mymodel_texture.jpg">
<param name=BGColor value="0xFFFFFF">
</applet>
```

This simply displays a model in a 320 by 200 pixel window in much the same way as the default generated template HTML code does. Other parameters that you can use when calling this applet are listed in Table 1.

The BGColor and FGColor options to set the background and foreground colours for the applet take hexadecimal numbers in the usual Java fashion with the first two digits representing the red colour component, the second two the green colour component and the last two the blue colour component.

The RotateX, RotateY and RotateZ parameters set the initial orientation (in degrees) of the 3-D model when first displayed by the applet.

The RotateXIncr, RotateYIncr and RotateZIncr parameters can be used to make the model automatically rotate around the x,y and z axes respectively at various rates, thus achieving an animated effect without the user having to manually rotate the object (although that remains possible too).

Table 1: Parameters for the D Sculptor Java Applet

Parameter	Default value	Function
Model		Name of the .cjg file (required)
Texture		Name of the texture map image file (required)
Background		Name of the background image file (optional)
BGColor	0xFFFFFF	Background colour
FGColor	0x000000	Foreground colour
Distance	4.0	Distance from viewpoint to object
RotateX	0.0	Initial rotation around x-axis
RotateY	0.0	Initial rotation around y-axis
RotateZ	0.0	Initial rotation around z-axis
RotateXIncr	0.0	Rotation around x-axis in degrees per second
RotateYIncr	0.0	Rotation around y-axis in degrees per second
RotateZIncr	0.0	Rotation around z-axis in degrees per second

4.8.5 Shockwave 3D Export

D Sculptor supports Macromedia's Shockwave 3D format for use with Macromedia's Director 8.5 (and higher) software.

To export in Shockwave 3D (.w3d) format select **File > Export > Shockwave 3D**. After entering a file name in the Save As dialog box you will be presented with the Shockwave Export Options dialog as shown in Figure 33.

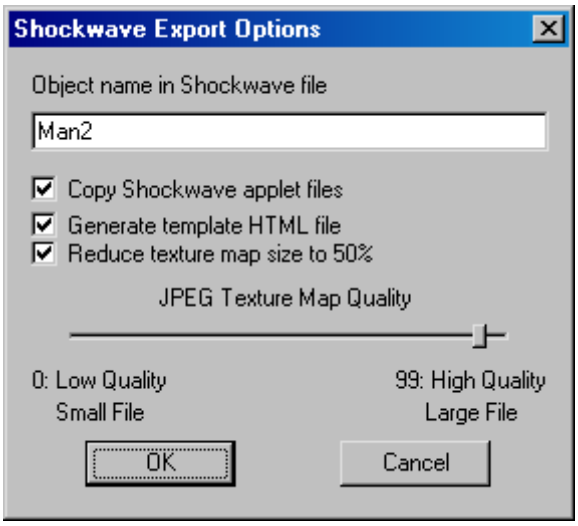

Figure 33: Shockwave Export Options dialog.

You can enter the name under which the model will be saved in the .w3d file. As a default D Sculptor will use the name of the exported .w3d file (without the file name extension). As with the Java export you can choose to reduce the texture map size to 50% (recommended) and set a JPEG quality factor for the exported texture map.

If you don't want to use the generated .w3d file with Macromedia Director but you want to publish it directly to the Internet then you can also choose to copy a Shockwave applet and template HTML file.

This template HTML file will contain code to embed a Shockwave applet as below. The various applet parameters actually have to be entered twice (once for Netscape and once for Internet Explorer). Both instances of the parameters are highlighted in red in the code below.

```
<object classid="clsid:166B1BCA-3F9C-11CF-8075-444553540000"
codebase="http://download.macromedia.com/pub/shockwave/cabs/director/sw.
        cab#version=8,5,1,0"
ID=sw3dviewer width=640 height=480>
<PARAM NAME=src value="sw3dviewer.dcr">
<PARAM NAME=swRemote value="swSaveEnabled='true' swVolume='true'
        swRestart='true' swPausePlay='true' swFastForward='true'
        swContextMenu='true' ">
<PARAM NAME=swStretchStyle value=stage>
<PARAM NAME=sw1 VALUE="Man2.w3d">
<PARAM NAME=sw2 VALUE="Man2">
<PARAM NAME=sw3 VALUE="cube_texture.gif">
<PARAM NAME=sw4 VALUE="80">
<PARAM NAME=bgColor VALUE=#FFFFFF>
<PARAM NAME=progress VALUE=FALSE>
<PARAM NAME=logo VALUE=FALSE>
<PARAM NAME=swStretchHAlign VALUE=Left>
<PARAM NAME=swStretchVAlign VALUE=Top>
<embed src="sw3dviewer.dcr" bgColor=#FFFFFF progress=FALSE logo=FALSE
        swStretchHAlign=Left swStretchVAlign=Top  width=640 height=480
        swRemote="swSaveEnabled='true' swVolume='true' swRestart='true'
        swPausePlay='true' swFastForward='true' swContextMenu='true' "
        swStretchStyle=stage type="application/x-director"
        pluginspage="http://www.macromedia.com/shockwave/download/"
        sw1="Man2.w3d" sw2="Man2" sw3="cube_texture.gif" sw4=100></embed>
</object>
```

A list of possible parameters and their meanings is given in Table 2.

Table 2: Shockwave applet parameters.

Parameter	Default value	Function
sw1	n.a.	Name of the .w3d file (required)
sw2		Name of the model within file (required)
sw3	cube_texture.gif	Name of texture for download animation
sw4	100	Scale value
sw5	0	Antialiasing (0=off, 1=on)
sw6	0	Initial rotation around x-axis
sw7	0	Initial rotation around y-axis
sw8	0	Initial rotation around z-axis

Please note that in order for the applet to be previewable on your local system (as opposed to when uploaded to the Internet) it *must* be saved into a (sub)directory named dswmedia as usual when previewing Shockwave applets with streaming media on a local system.

4.8.6 VRML Export

To export in VRML 2.0 (.wrl) format select **Export > VRML 2.0**. After entering a file name in the Save As dialog box the JPEG quality dialog box shown in Figure 31 will appear and you can set a JPEG quality factor for the exported texture map.

4.8.7 Wavefront Export

To export in Wavefront (.obj) format select **Export > Wavefront**. After entering a file name in the Save As dialog box the JPEG quality dialog box shown in Figure 31 will appear and you can set a JPEG quality factor for the exported texture map.

4.8.8 Bitmap Export

Exporting as a bitmap image results in the precise view shown in 3D mode being saved to a bitmap file.

4.8.9 Copying 3D Mode Views to the Clipboard

In order to copy the image currently displayed in 3D Mode to the Windows clipboard select **Edit > Copy** or press **[Control]+[C]**. After doing this the image is available for pasting into other software applications that use bitmap images.

4.9 THE OPTIONS MENU

Most settings for D Sculptor can be adjusted in the options dialog. To reach this select **Tools > Options** or click on the options button on the toolbar. The settings in the options dialog are subdivided by three tabs: Mesh, Photograph and 3D.

4.9.1 The Mesh Options Tab

Under the Mesh tab (Figure 34) you can adjust the voxel resolution, default number of polygons and whether D Sculptor shows the calculation dialog while calculating.

The voxel resolution: When D Sculptor generates a mesh it initially builds up a model out of notional volume elements (voxels). For example at the setting of 200 as shown in the figure D Sculptor would use a volume of 200x200x400 voxels.

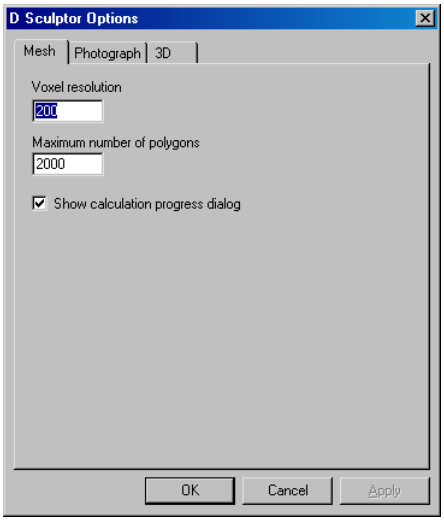

Figure 34: Mesh options.

Choosing a high value for the voxel resolution gives more detailed models but the amount of memory used and the time taken to generate the model will increase. For most applications a value of 100 will be sufficient. The maximum value that can be set is 300.

Default number of polygons: this is the number of polygons which D Sculptor produces when a mesh is first generated.

Show calculation progress dialog: if this box is ticked D Sculptor will show the calculation progress dialog box every time a mesh or a texture map is generated. If the box is not ticked then D Sculptor will not show the dialog.

4.9.2 The Photograph Options Tab

Under the Photograph tab (Figure 35) you can adjust what is displayed in photo mode and which marker pattern is used.

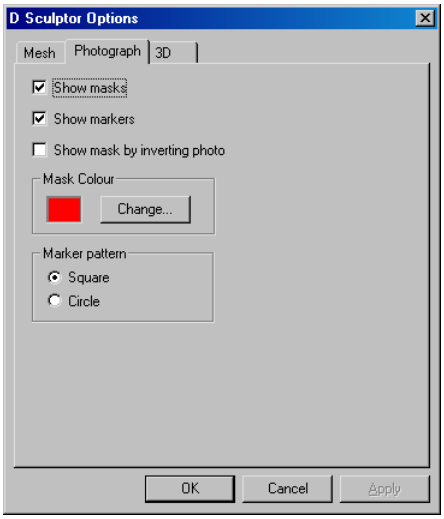

Figure 35: Photograph options.

Show masks: if this box is ticked then D Sculptor will show the currently active mask superimposed on the current photo. If the box is not ticked then D Sculptor will not display the mask. This setting can also be turned on or off by using the **Toggle Masks** button on the toolbar.

Show markers: if this box is ticked then D Sculptor will display any markers than have been found or entered superimposed on the current photo. If the box is not ticked then D Sculptor will hide any markers that may be present. This setting can also be turned on or off by using the **Toggle Markers** button on the toolbar.

Mask colour: by clicking on the **Change…** button you can change the colour D Sculptor uses fore mask overlay.

Marker pattern: by selecting one of the two radio buttons you can choose which marker pattern D Sculptor uses. For most applications the circular marker pattern is recommended as it can be automatically and accurately picked up but for some special applications you may want to use the square pattern. See also Section 3.3.

4.9.3 The 3D Options Tab

Under the 3D tab (Figure 36) you can adjust a number of options that have to do with the way models are displayed in 3D mode.

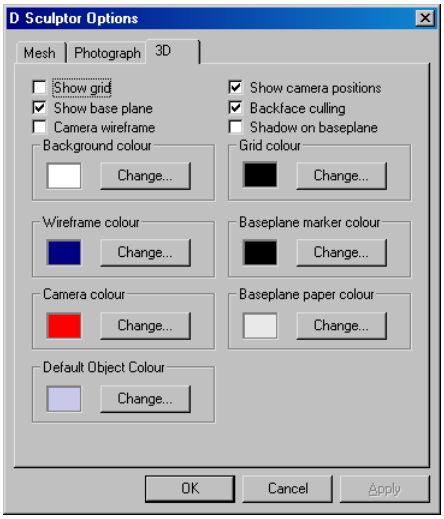

Figure 36: 3D options.

The following options can also be set via the popup menu that appears when you right click over the 3D workspace in model mode:

- Show grid
- Show base plane
- Show camera positions
- Backface culling

Show grid: turn the display of the grid under the model on or off.

Show base plane: turn the display of the base plane (a facsimile representation of the circular marker pattern) under the model on or off.

Camera wireframe: determines whether cameras (if shown) are shown shaded or just as wire frames. It can be convenient to displays the cameras as wire frames because rendered like this it is possible to see through them.

Show camera positions: when this option is activated camera positions for calibrated photos will be graphically represented in the 3D workspace.

Backface culling: this option is only relevant when viewing a model as a wire frame. When backface culling is turned on polygons at the back of the object will not be rendered. When backface culling is turned off all triangles will be rendered.

Shadow on base plane: if display of the base plane is activated and this option is turned on then a shadow of the currently modelled object will be shown on the base plane.

Background colour: the colour of the background in 3D mode. Note that this setting has no effect if a background bitmap is loaded (see Section 4.5.3).

Wire frame colour: the colour used for the wire frame when a 3D model is displayed as a wire frame.

Camera colour: the colour in which the cameras are rendered if display of camera positions are turned on.

Default object colour: the colour in which objects are drawn with flat shading or smooth shading before a texture map has been generated. When there is a texture map available the colours used for flat shading and smooth shading will be taken from the texture map.

Grid colour: the colour in which the grid under the object will be draw if display of the grid is turned on.

Base plane marker colour: the colours in which markers will be drawn on the base plane if display of the base plane is turned on.

Base plane paper colour: the colour of the base plane itself.

4.10 KEYBOARD SHORTCUTS

Many functions and operations in D Sculptor can be accessed via keyboard shortcuts as well as mouse-click combinations.

Table 3: Photo mode zoom keys

Function	Key
Zoom to 50%	**[Ctrl]+[5]**
Zoom to 100%	**[Ctrl]+[1]**
Zoom to 200%	**[Ctrl]+[2]**
Zoom to 400%	**[Ctrl]+[4]**
Zoom to Mask	**[T]**
Zoom to fit	**[F]**
Zoom in	**[Page Up]**
Zoom out	**[Page Down]**

Table 4: Shortcuts for photo mode tools

Tool	Key
Magic Wand Tool	**[W]**
Initialise Mask	**[N]**
Irregular Mask Tool	**[K]**
Rectangular Mask Tool	**[R]**
Selection Tool	**[S]**
Marker Tool	**[M]**
Zoom Tool	**[F2]**
Pan Tool	**[F3]**
Round Brush Tool	**[P]**
Square Brush	**[B]**
Additive Mask Mode	**[+]**
Subtractive Mask Mode	**[-]**

Table 5: Standard Windows shortcuts

Function	Shortcut
File Open	**[Ctrl]+[O]**
File Save	**[Ctrl]+[S]**
File New	**[Ctrl]+[N]**
Edit Copy	**[Ctrl]+[C]**
Edit Undo	**[Ctrl]+[Z]**

Table 6: 3D mode shortcuts

Function	Key
Anti-aliasing	**[A]**
Toggle 3D mode	**[SPACE]**
Wire frame rendering	**[F5]**
Flat shaded rendering	**[F6]**
Gouraud shaded rendering	**[F7]**
Smooth shaded rendering	**[F8]**
Front view	**[F9]**
Left view	**[F10]**
Back view	**[F11]**
Right View	**[F12]**
Zoom Tool	**[F2]**
Pan Tool	**[F3]**
Rotate Tool	**[F4]**

Table 7: Other shortcuts.

Function	Key
Find Markers	**[Ctrl]+[F]**
Stop Calculation	**[Esc]**

4.11 THE TOOLBARS

The buttons on the D Sculptor toolbars are shown in Figure 37.

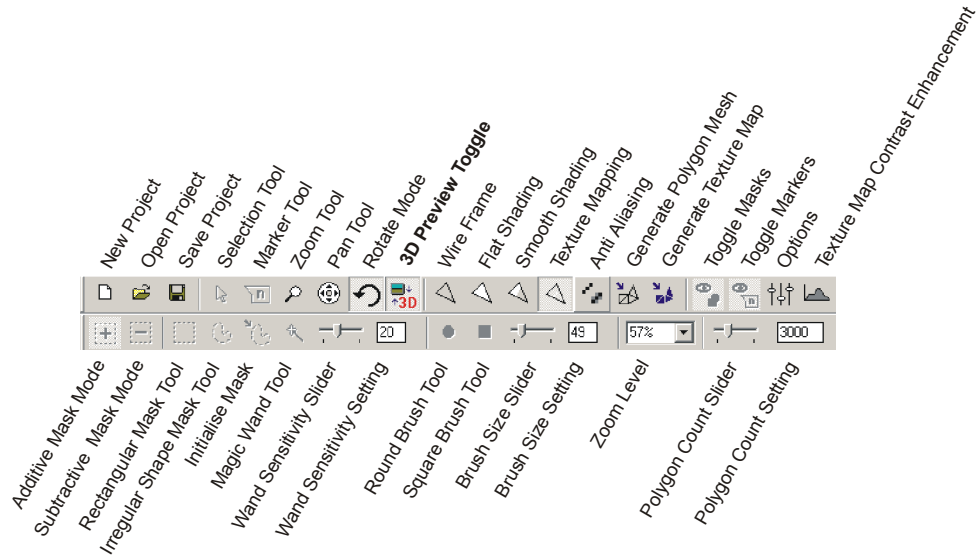

Figure 37: Toolbar buttons.